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Vegetative reproduction and aposporous growths from the young sporophyte of Polypodium irioides

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(WITH THREE TEXT FIGURES)

From an old culture of the prothallia of *Polypodium irioides* Poir. made March 21, 1916, the largest gametophytes, including a number bearing sporophytes, were on several occasions removed for class use. In the autumn of 1918, when regeneration from the sporophyte was first observed, only three sporophytes remained in the culture.

The largest and most vigorous bore six leaves and by March 4, 1919, had produced nine leaves. The largest leaf of this sporophyte was about 5 cm. in length and 5 mm. in width. From one of the smaller leaves of the sporophyte regeneration occurred. This leaf was only 1 cm. in length and 3 mm. in width. There was a well-developed vein in the leaf and the epidermal cells, including the guard cells, were of the usual type. It was impossible to determine whether the leaf was the primary one, since the juvenile leaves of this fern resemble closely one another and also the leaves of the mature sporophyte. Three of the sporophytic growths produced by the leaf originated along the margin (FIG. 1, *b*, *c*, and *f*), one from the lower surface (*d*), and one from the upper surface (*c*).

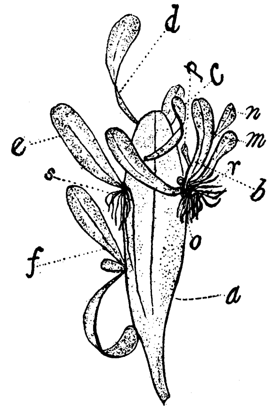

FIG. 1. A leaf of a young sporophyte of *Polypodium irioides*, which has produced secondary sporophytes and secondary leaves, x 3.

From two portions of the leaf were developed complete sporophytes, that is, sporophytes with both leaves and roots (FIG. 1, *b* and *c*). The other outgrowths consisted of one or more leaves, and one bore in addition to two leaves numerous rhizoid-like hairs from the point of origin of the leaves (*s*). These were extremely long, and in respect to length resembled root hairs. None of the sporophytic outgrowths were connected with the vein of the leaf of the sporophyte.

By March 4, 1919, the parent leaf had increased little in size. At this time it was observed that a leaf (*m*) of one of the complete sporophytes (*b*) had regenerated and produced in turn three outgrowths (FIG. 1, *o*, *n*, and *p*), which later developed into leaves.

The two complete sporophytes were detached and planted on *Sphagnum*. From one of the sporophytes (*b*) a leaf (*n*) was removed and was likewise planted on *Sphagnum*. The two sporophytes lived only a short time. From the detached leaf (*n*) it was discovered, May 12, 1919, that four outgrowths had been produced. Three of these were gametophytic, and the other sporophytic. A portion of the leaf and two of the young prothallia (*m* and *n*) are represented in FIG. 2. One of the outgrowths produced a large cell (*a*), probably apical in nature. The three gametophytic or prothallial growths developed from the leaf of the sporophyte are aposporous. The cells of the leaf surrounding the gametophytic developments are somewhat intermediate between the two generations. The parent leaf soon showed signs of exhaustion and June 15, 1919, was partially dead. Later all of the outgrowths of the leaf died.

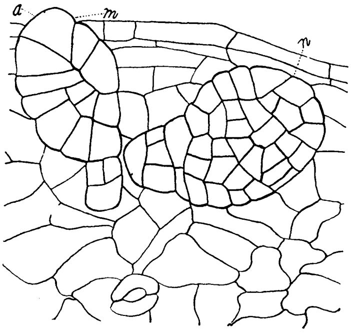

FIG. 2. Aposporously produced prothallia from a leaf of *Polypodium irioides*, x 200.

Another sporophyte in the culture produced from each of the leaves a normal leaf. Roots were not developed. Since the sporophyte bore three leaves, one of the regenerating leaves was a secondary one.

The remaining sporophyte bore four leaves, each of which developed one or more outgrowths. In one instance a leaf produced a cylindrical structure distinctly gametophytic in its cellular nature. It produced numerous rhizoids at its point of origin. This gametophytic outgrowth was also of aposporous origin. A normal leaf was formed by another of the four leaves. At the base of the third leaf two small cellular masses appeared, probably sporophytic in nature. The fourth leaf produced a similar cellular mass, represented in section by FIG. 3. In no case were these cellular masses connected with the vascular system of the leaf. It is of interest to note in this case that all of the leaves of the sporophyte produced outgrowths.

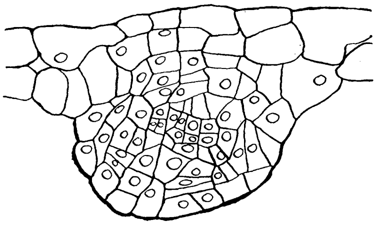

FIG. 3. A section through a cellular mass produced from the leaf of *Polypodium irioides*, x 200.

The cultural conditions under which regeneration from the sporophyte and apospory occur in *Polypodium irioides* are not known to the writer. The phenomena appeared in an old culture in which the conditions may have been unfavorable for the normal development of the sporophyte. It may be added, however, that a fresh supply of a nutrient solution was on several occasions applied to the culture.

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